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Short-term physical exercise as a means of treatment in obesese and diabetic patient

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Abstract

Background: Type 2 diabetes usually occurs in people of advancing age and affects more obese or overweight people. The practice of regular physical exercise is a means of treatment or prevention of this pathology.

Methods: The present study aims was to appreciate effects of 15-minute exercise program at intensity between 65% to 70% of HRmax in obesese and type 2 diabetic patient. Thirty (30) single randomly sampled type 2 diabetic women took part in experiment. The physical exercise program is eight (08) weeks at the rate of five (05) sessions per week.

Result: The results at the end of this program showed a decrease in biometric and biochemical parameters.

Conclusion: They prove that intense short-term physical exercise is an effective means in prevention and non-drug treatment of type 2 diabetes.

Keywords: type 2 diabetes, obese, short-term physical exercise, treatment

1. Introduction

The non-transmissible diseases evolve all over the world. They are the leading cause of early death and disability worldwide [1-2]. This has the corollary of catastrophic social and economic situations in every countries, especially among the poor and sensitive populations, notable absences of workers and by extension a drop in productivity [3]. The non-transmissible diseases have in common well-known risk factors, the control of which allows an integrated reduction in the burden of disease and mortality. These include behavioral risk factors such as tobacco use, harmful alcohol consumption, physical inactivity, unbalanced diet [4]. These factors are preventable. But when they take hold, they contribute to the development of biological factors that are sources of non-transmissible diseases [2].

Physical inactivity is the leading cause of preventable death from non-transmissible diseases and it is the cause of two million deaths per year worldwide [5-6]. Diabetes and obesity are among of non-transmissible diseases and its effect induces and develops pathologies including cardiovascular diseases, myocardial infarction, hypertension, cerebrovascular accidents and arteritis of the lower limbs [7]. The development of obesity is one of the major risk factors for the development of type 2 diabetes [5-8].

Type 2 diabetes usually occurs in people of advancing age and affects more obese or overweight people. In Benin, more than 71% of the population does not practice moderate and regular physical activity, and 98% carry the risk of contracting non-transmissible diseases [9-11]. Diabetes strongly impairs the patient's quality of life through its micro and macro vascular complications which decrease life expectancy by 25% on average in patients with an average age of 40-50 years [8]. In industrialized countries, diabetes is one of the top five causes of death and disability. Today, in most industrialized countries, the prevalence of diabetes in the adult population (aged 20 to 79) has reached about 6% [12, 1]. In 2025, it is estimated that 380 million people have diabetes (80% of whom live in developing countries), or more than 7% of the global adult population [12].

In Benin, the prevalence of diabetes doubled from 2006 to 2011 (1.1%_2.6%) and recent surveys revealed its gradual increase in the Borgou department [11].

This study aims was to appreciate effects of 15-minute exercise program at intensity between 65% to 70% of HRmax for management obeses and type 2 diabetic patient.

2. Materials and Methods

2.1 Participants

The sampling strategy has led to explaining to all subject the object of the study. They are women who not practice sport. This study received the approval of the ethics committee and it was conducted according to the principles of the Helsinki Convention (1974). The experiments were performed according to the Institutional Ethics No. 084 MS/DC/SG/DFRS/CNPERS/SA (University of Abomey Calavi, Benin). The non-random sampling technique was used and a power analysis was performed to determine the sample size. With a power of 0.80, thirty (30) sedentary women participated in the study.

2.1.1 Inclusion Criteria

The study subjects met the following criteria

- Give free and informed consent;
- Reside in the city of Parakou in Benin;
- Have a blood sugar level greater than 1.2g/L;
- Have a Body Mass Index greater than or equal to 25.
- Be voluntary and available

2.1.2 Exclusion Criteria

- Have a joint disease in at least one of the lower limbs;
- Be undergoing medical treatment during the experiment;
- Have a sporting activity likely to influence the results of the study;
- Be in menopause;
- Present ailments during the program;
- Make less than 05 sessions per week.

2.2 Protocol

Domyos brand stepper MS 100 with double pedals without lateral oscillations for people weighing on average 100 kg was used. The difference in height between the two pedals is 20 cm, a distance corresponding to the usual known standards between two building stairs. Stepper is equipped with a pedometer and a simultaneous stopwatch, allowing you to read the number of steps of walker and the time of journey, as well as energy expenditure.

A pre-test comparing values of maximum heart rate during exercise on the stairs and then on stepper made it possible to validate the protocol.

Individual arterial tension was taken by a doctor from Departmental Hospital of Borgou (Region of city of Parakou) to ensure subject's blood pressure profile and its compatibility with effort.

Biometric data has been collected. A blood sample was taken at start and at end of the program for laboratory analysis of blood sugar, triglycerides, HDL cholesterol, total cholesterol and LDL cholesterol. The subjects are made a program of climbing stairs (stepper pedals) for 15 minutes per session at rate of 05 sessions per week over 02 months (08 weeks). The subjects' maximum exercise frequency was between 60% to 70% HRmax. The subject is in upright posture, standing on stepper and applying an alternating vertical strength to stepper pedals. Deep support and full extension of the supporting leg are required in order to obtain the maximum effort required for stair climb.

2.3 Statistical analysis

Comparisons of the mean values of start and end of the program were made using the Wilcoxon nonparametric test for matched samples. The level of significance is set at $p < 0.05$.

3. Result

At the end of the program, subjects' body mass, BMI and FI decreased (table 1). The decrease is significant in body mass ($p = 0.0036$)

Table 1: Variation of biometric parameters

	Topics (N = 30; 44.60 ± 7.08 years)	
	Start	End
Weight (kg)	77.6 ± 7,83	74.5** ± 7.43
BMI (Kg/m ²)	28.9 ± 2.65	27.8* ± 2.53
FI	35 ± 3.92	33.6* ± 3.86

BMI: Body Mass Index; FI: Fat Index, N = Workforce, * $p < 0,05$; ** $p < 0,01$

Table 2 shows a decrease in triglycerides, total cholesterol, and LDL, and an increase in HDL at the end of the exercise program.

Table 2: The lipid profile of subjects

	Lipid parameters (g/L)			
	Trig	Chol-T	HDL	LDL
Start	0.444 ± 0.011	1.697 ± 0.13	0.256 ± 0.061	1.322 ± 0.49
End	0.371* ± 0.052	1.354* ± 0.058	0.541** ± 0.97	0.09** ± 0.010

trig = triglycerides; chol-t = total cholesterol; hdl = high density lipoprotein; ldl = low density lipoprotein; * $p < 0.05$; ** $p < 0.01$

The exercise program improved subjects' performance (table 3). The number of stairs step performed as well as the energy

expenditure between the start and the end of program have significantly increased ($p = 0.0059$ and $p = 0.008$)

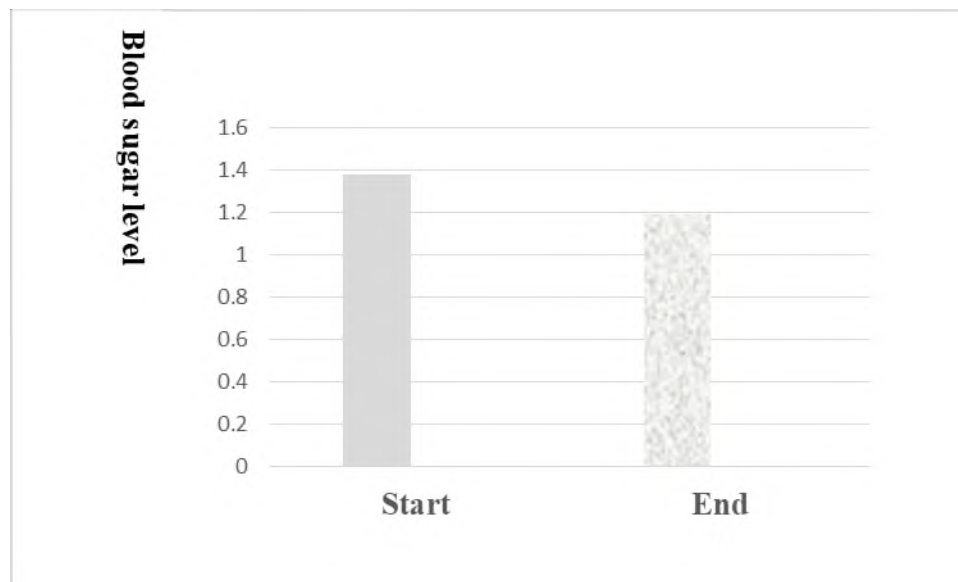


Fig 1: Evolution of blood sugar

Table 3: Subjects work per session

	Topics (N = 30 ; 44.60 ± 7.08 years)	
	Start	End
Stairs step	542 ± 36	630** ± 41
EE (KJ)	297 ± 16.96	345** ± 29.45

EE: energy expenditure, *p< 0,05; **p<0,01, n = workforce

4. Discussion

Women who took part in this study represent part of the pre-obese and diabetic population of city of Parakou. The results obtained therefore remain valid for this region and cannot be generalized even if they are similar to those of Lawani *et al* [6] on variation of blood triglyceride cholesterols in obese Beninese women [12].

There is a very significant decrease in blood sugar after 2 months of physical exercise.

The advantage derived from this program by daily practice and short duration (15 min) corroborate those of Murphy *et al.* [10] according to which, "if the physical activity is more intensive, the duration of this exercise can be reduced from 30 to 10 minutes per day with the same effects" [12]. This program matches that of other author's ideas, for whom "the accumulation of several short periods (10-15 min) of activity is as beneficial as a long period totaling the same duration" [4-6].

A weekly estimate of the average energy expenditure revealed by the study is 2415 KJ. Other study evaluated an expenditure of 5 km of low-intensity walking at 780 KJ, according to WHO recommendations, 390 KJ per 30-minute session, for 1170 KJ in 150 minutes of walking [2]. Comparison of the data shows more than double of energy expenditure through the short-term exercise that was the subject of this study. This program provides a high benefit for mobilization of subject's blood glucose. And it is what justifies the significant drop in blood glucose at the end of exercise program.

The modification of physiological variables is similar to that of the evaluation of cardio-respiratory parameters during the stair climbing test and the 6 minutes walking test, showing that Heart rate and dyspnea increase more significantly during the staircase test than during the 6-minute walk test [13].

5. Conclusion

This short-term physical exercise program relieves populations of the time constraints for the efficient

management of chronic diseases and the treatment of diabetes from a simple, transportable device that can be operated in a sedentary workplace.

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